weather report
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BY MICHAEL KJELGAARD, P.E.

A YEAR IN REVIEW: ASHRAE DESIGN CONDITIONS VS. 2002

The end of June '03 marks the second anniversary for the Weather Report, and I would like to thank all of you who have volunteered your $.02 along the way. The feedback has been very helpful in our effort to try and achieve our dual goal of becoming a dependable weather data resource as well as a good source for useful and practical "hands on" HVAC systems design and operational information. So keep those e-mails coming. Also, note that the monthly data table (Figure 1) has been modified to reflect only cooling related data since we are now well into summer, and it just didn't make sense to waste space by reporting a bunch of zeroes. Heating related values will be reinstalled when fall comes around again.

We never got around to taking a look back at the totals for 2002, so now is as good a time as any, and I thought it would be a good idea to start with ASHRAE design conditions. Just to refresh, the ASHRAE design outdoor air conditions are published in the 1997 ASHRAE Fundamentals Handbook for 1,459 locations around the world. These values are used to determine required heating and cooling equipment capacities for HVAC systems and other energy related processes. The 0.4%, 1.0%, and 2.0% design values for outside air dry bulb and wet bulb temperatures represent the temperatures that are exceeded 0.4%, 1.0% and 2.0% of the year on average, or 35, 88, and 175 hours per year respectively. Similarly, the outside air dry bulb temperature is less than the heating 99.6% and 99% design values 35 and 88 hours per year respectively.

Figures 2 and 3 indicate that the '02 cooling season was very demanding on air conditioning systems all over the country. The expected 35, 88, and 175 hours for design dry bulb and wet bulb values were exceeded many times over in many locations with the exception of western cities. In some cases, the design wet bulb hours were off the chart. In Miami, there were 775 hours above 2.0% design. That's almost 4.5 times the average of 175 hours!

Higher wet bulb temperatures mean higher cooling ventilation loads. And as some of you have experienced, if the wet bulb temperature is continuously greater than the temperature that a cooling tower was sized for, it could be load-shedding time. Wet bulb temperature is very volatile year to year, and sometimes it's a good idea to take a look at some actual data when designing a ventilation system or selecting a cooling tower, especially in critical design applications.

On the heating side (Figure 4), the number of hours below the heating design values were lower than normal pretty much across the country. Not quite what I expected to see, given what seemed to be a long winter. Note however that Figure 4 reflects the '02 calendar year and does not include the early '03 winter months. **ES**

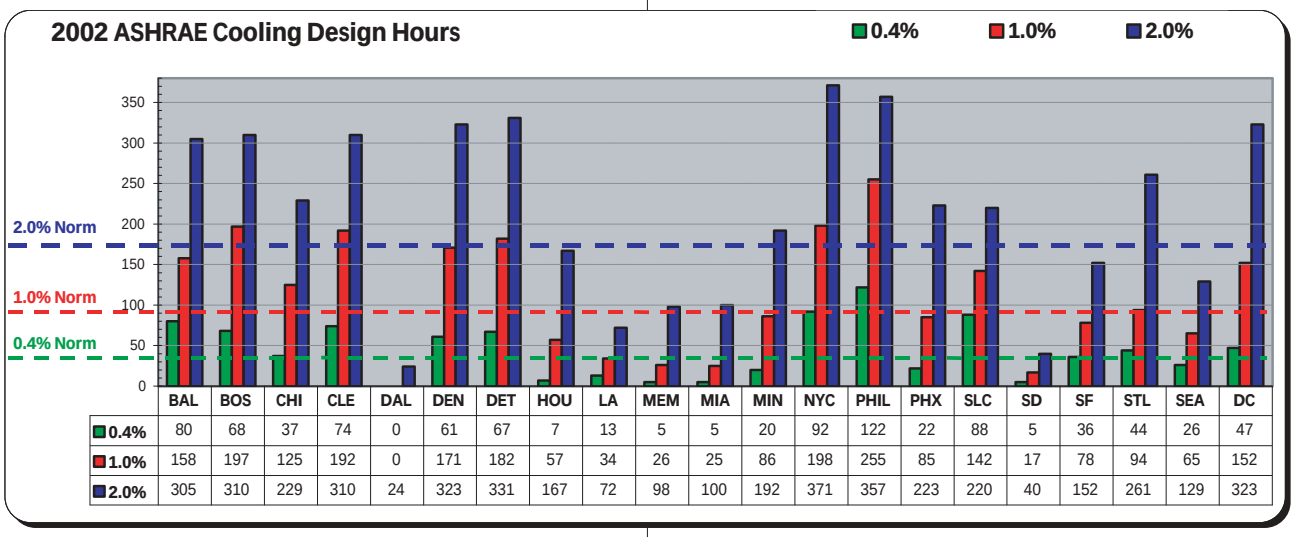
Kjelgaard is the author of Engineering Weather Data *(published by McGraw-Hill and available at Amazon.com), a weather data handbook for hvac system design and energy consumption analysis. He is a senior project engineer with Shooshanian Engineering in Boston. For suggestions and comments, write him at* **mkjelgaard@shooshanian.com** *or fax to 617-426-7358.*

June 2003	Degree Days (Base 65 F)				Dry Bulb Temperature				Wet Bulb Deg F		Hum. Ratio Grains / Lb		Enthalpy Btu / Lb		VLIc Sensible Ton-hr / cfm		VLIc Latent Ton-hr / cfm		VLIc Total Ton-hr / cfm	
	HDD	N	CDD	N	Max Deg F	N	Min Deg F	N	Max	Min	Max	Min	Max	Min	Jun	N	Jun	N	Jun	N
Atlanta	0	1	275	354	87	94	56	57	78	53	146.7	52.0	41.9	22.0	1.23	1.32	1.23	0.86	2.46	2.17
Baltimore	31	10	172	243	92	95	45	49	77	43	127.8	36.4	39.9	16.5	0.95	1.14	0.75	0.83	1.70	1.97
Boston	77	48	85	143	89	93	50	50	79	46	136.1	28.3	42.4	17.9	0.66	0.77	0.53	0.31	1.19	1.07
Chicago	71	48	86	160	92	93	38	43	75	37	105.8	21.8	37.9	13.7	0.75	0.98	0.19	0.45	0.94	1.43
Cleveland	52	50	107	152	90	92	41	43	77	39	121.6	30.6	40.2	15.0	0.80	0.95	0.41	0.59	1.21	1.55
Dallas	0	0	424	492	94	99	60	60	80	60	139.4	67.7	44.2	26.7	1.53	1.63	1.62	1.26	3.15	2.90
Denver	110	55	26	131	86	95	40	42	65	40	111.1	27.7	35.9	16.2	0.48	0.70	0.02	0.00	0.50	0.71
Detroit	51	46	105	140	90	92	42	44	77	40	124.8	25.7	40.5	15.1	0.80	0.89	0.30	0.43	1.10	1.32
Houston	0	0	517	485	97	97	67	62	83	66	161.9	64.8	46.3	31.1	1.73	1.61	2.38	1.91	4.11	3.52
Los Angeles	8	22	16	52	73	82	59	55	65	57	81.3	61.8	30.0	24.0	0.58	0.57	0.29	0.23	0.87	0.79
Memphis	0	0	289	425	92	96	56	58	79	55	132.4	58.7	41.8	23.4	1.30	1.54	1.15	1.45	2.45	2.99
Miami	0	0	520	500	91	93	73	70	81	71	156.0	86.4	44.6	34.5	1.74	1.69	2.62	2.05	4.36	3.74
Minneapolis	30	47	117	146	88	93	49	44	78	45	135.2	30.0	41.9	17.8	0.87	0.91	0.27	0.47	1.14	1.38
New York City	40	13	159	222	95	93	51	52	78	47	119.3	34.3	40.6	18.7	0.89	1.06	0.56	0.37	1.44	1.42
Philadelphia	25	11	202	232	95	94	53	50	78	47	141.2	32.3	41.6	18.6	1.06	1.04	0.92	0.65	1.98	1.70
Phoenix	0	0	812	688	112	112	72	62	70	49	62.4	12.9	35.2	20.0	2.43	2.27	0.00	0.01	2.43	2.29
Salt Lake City	26	52	196	167	98	98	34	42	62	42	72.2	11.5	29.3	10.2	1.11	0.86	0.00	0.00	1.11	0.86
San Diego	33	12	15	66	73	82	59	57	66	56	86.2	53.2	30.6	23.5	0.55	0.78	0.24	0.28	0.78	1.06
San Francisco	146	125	31	19	96	88	50	48	67	43	86.3	10.6	31.1	16.5	0.41	0.28	0.02	0.01	0.42	0.29
St. Louis	25	6	199	321	91	96	49	52	79	48	129.7	35.8	42.5	19.0	1.09	1.30	0.69	1.33	1.78	2.63
Seattle	117	152	49	21	90	85	48	45	68	47	80.1	23.0	31.8	18.3	0.52	0.35	0.01	0.01	0.53	0.36
Washington, DC	15	4	203	301	92	95	53	54	76	46	126.5	34.0	39.5	18.2	1.03	0.98	0.85	0.84	1.87	1.82

1.) GENERAL - Derived from raw data furnished by the National Weather Service (NWS). Normal values (N) are from the historical record provided by the National Climatic Data Center (NCDC). Normal values for VLI were derived from the TMY2 data set compiled by the National Renewable Energy Laboratory using the 2003 calender for equal number of weekdays. Based on 24 Hr operation.

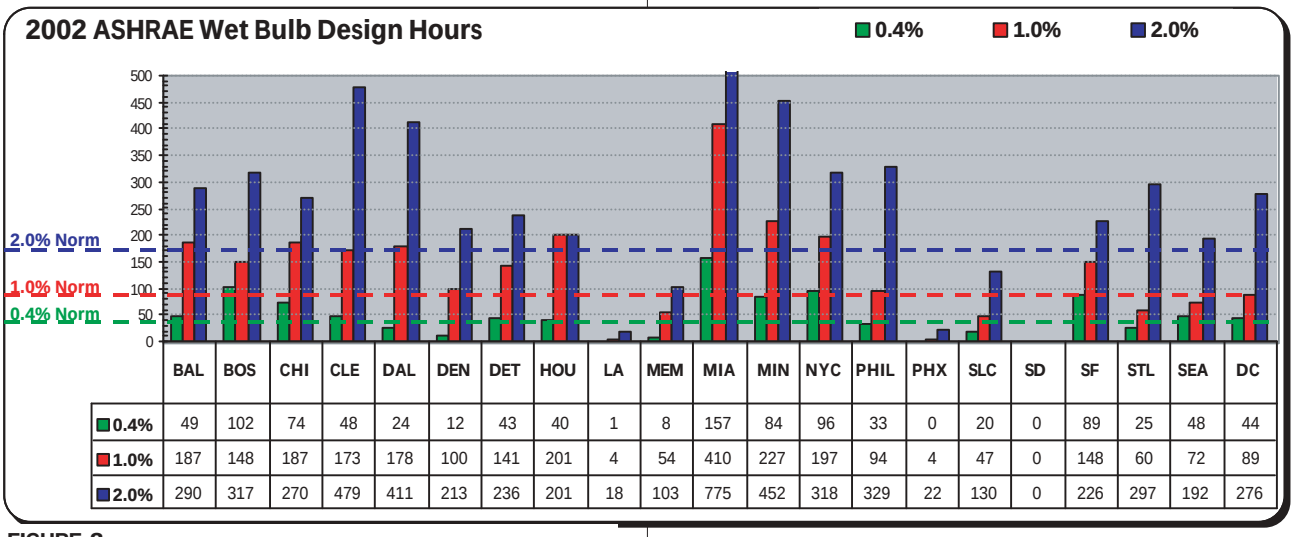
2.) COOLING VENTILATION LOAD INDEX's (VLIc) - Sensible, latent and total energy required per cfm of outdoor air to maintain 55 F discharge air temperature. VLIc in Ton-hrs / cfm. Calculated hourly. Based on 24 hr operation.

FIGURE 1.



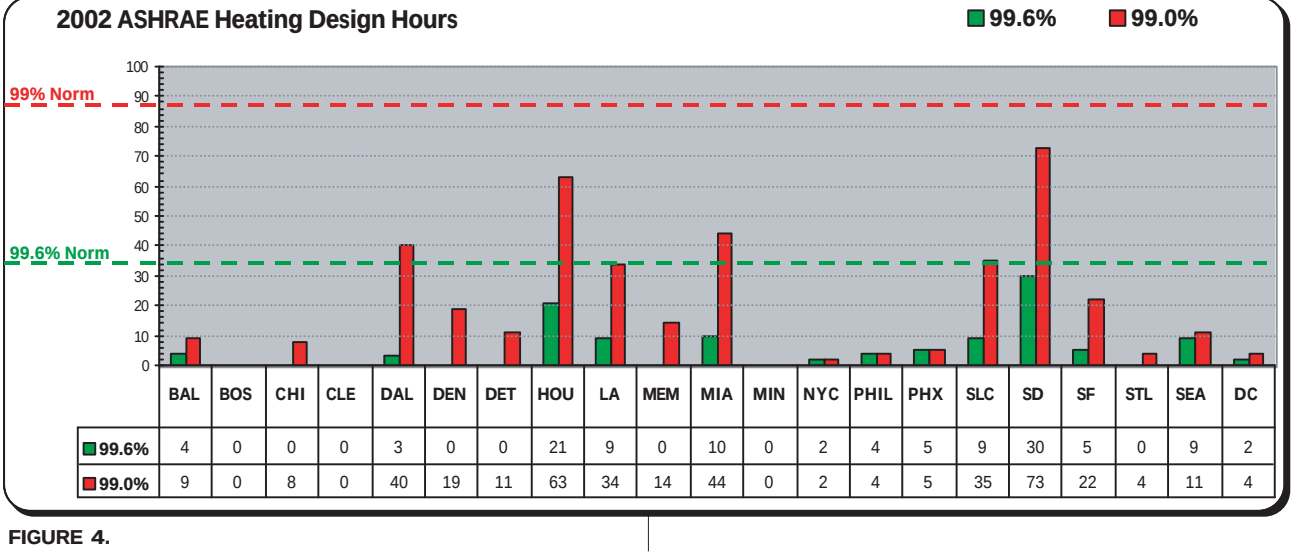
	BAL	BOS	CHI	CLE	DAL	DEN	DET	HOU	LA	MEM	MIA	MIN	NYC	PHIL	PHX	SLC	SD	SF	STL	SEA	DC
0.4%	80	68	37	74	0	61	67	7	13	5	5	20	92	122	22	88	5	36	44	26	47
1.0%	158	197	125	192	0	171	182	57	34	26	25	86	198	255	85	142	17	78	94	65	152
2.0%	305	310	229	310	24	323	331	167	72	98	100	192	371	357	223	220	40	152	261	129	323

FIGURE 2.



	BAL	BOS	CHI	CLE	DAL	DEN	DET	HOU	LA	MEM	MIA	MIN	NYC	PHIL	PHX	SLC	SD	SF	STL	SEA	DC
0.4%	49	102	74	48	24	12	43	40	1	8	157	84	96	33	0	20	0	89	25	48	44
1.0%	187	148	187	173	178	100	141	201	4	54	410	227	197	94	4	47	0	148	60	72	89
2.0%	290	317	270	479	411	213	236	201	18	103	775	452	318	329	22	130	0	226	297	192	276

FIGURE 3.



	BAL	BOS	CHI	CLE	DAL	DEN	DET	HOU	LA	MEM	MIA	MIN	NYC	PHIL	PHX	SLC	SD	SF	STL	SEA	DC
99.6%	4	0	0	0	3	0	0	21	9	0	10	0	2	4	5	9	30	5	0	9	2
99.0%	9	0	8	0	40	19	11	63	34	14	44	0	2	4	5	35	73	22	4	11	4

FIGURE 4.